High-Speed Research-Propulsion Project Accomplishments

High-Speed Civil Transport (HSCT).

This past year has been one of great technical accomplishment for the propulsion element of NASA's High-Speed Research (HSR) Program. The HSR Program is a NASA/industry partnership to develop the high-risk/high-payoff airframe and propulsion technologies applicable to a second-generation supersonic commercial transport, or High-Speed Civil Transport (HSCT). The NASA Lewis Research Center manages the propulsion element, which also includes industry participation. These technologies will contribute greatly to U.S. industry's ability to make an informed product launch decision for an HSCT vehicle. Specific NASA Lewis accomplishments in 1998 include

- The lean premixed prevaporized combustor concept was selected for follow-on full-scale development. The combustor concept has demonstrated the ability to produce ultra-low emissions of less than 5 g of nitrogen oxides (NO_x) per kg of fuel burned while maintaining a combustion efficiency of greater than 99.9 percent with minimal technical or developmental risks.

- Combustor sector tests were initiated in CE-9 of the Engine Research Building to evaluate ceramic matrix composite parts in a realistic combustor environment.

- An alternative metal combustor liner was assessed. These tests showed that metal liners made from nickel-based superalloys and coated with a thick thermal barrier coating can meet HSR emission and life goals.

- The Large Scale Model 1 (LSM-1) test, which was conducted to test a nozzle design in a large-scale, more realistic engine environment, was completed. The goal was to improve confidence in the ability of the nozzle technologies being developed to meet the noise goals of the HSR Program. The test not only showed that the technologies are on track but successfully demonstrated the use of ceramic matrix composite tiles in HSCT engine applications.

- Over 18 000 hours of durability testing were completed for all four advanced materials systems in Lewis' materials laboratories. Superalloy, gamma-titanium aluminide, ceramic matrix composite, and thermal protection system performance were evaluated for HSCT nozzle applications.

- A turbomachinery disk alloy was selected for a large-scale processing effort. This alloy has mechanical properties far superior to current production materials and is projected to meet HSCT requirements.

- A concept for a second generation, two-dimensional, mixed-compression supersonic inlet was coupled to a turbojet engine and tested in Lewis' 10- by 10-Foot Supersonic Wind Tunnel. The extensive data base of results for inlet/engine operability and unstart conditions contributed to the maturation of inlet technologies for future commercial supersonic transport vehicles.

- Proactive transfer of HSR propulsion technologies to other NASA programs has been initiated. Specifically, an economic fabrication technique for sheet titanium aluminide developed for the HSCT exhaust nozzle is being considered for use in the thermal protection system for both the reusable launch vehicle and X-33 programs.

For more information, visit Lewis' HSR and aeropropulsion facility sites:

HSR: http://www.grc.nasa.gov/WWW/HSR
Engine Research Building: http://www.grc.nasa.gov/WWW/AFED/facilities/erb.html
Propulsion Systems Laboratory: http://www.grc.nasa.gov/WWW/AFED/facilities/psl.html
Aero-Acoustic Propulsion Laboratory: http://www.grc.nasa.gov/WWW/AFED/facilities/aapl.html
10- by 10-Foot Supersonic Wind Tunnel: http://www.grc.nasa.gov/WWW/AFED/facilities/10x10.html

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